No of Pages : 3 Course Code : 08P005

Roll No:
(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, APRIL - 2014

BE(SW) - PRODUCTION ENGINEERING Semester : 8

08P005 FINITE ELEMENT APPLICATIONS IN MANUFACTURING

Time : 3 Hours **Maximum Marks : 100**

INSTRUCTIONS:

1. Group I and Group II questions should be answered in the Main Answer Book.
2. Answer any **6** questions in Group II.
3. Answer **ALL** questions in Group I and Group III.
4. Group III – **Multiple Choice questions** - (which will be given to the candidates half an hour before the scheduled close of the examination) **should be answered only** in the space provided **in the Main Answer Book.**
5. **Use of Design data book/tables not permitted.**
6. Symbols used are as per standards. **Suitable assumptions can be made wherever necessary.**

GROUP I **Marks : 10 x 3 = 30**

1. What are the objectives of using FEA to solve manufacturing problems? Answer with examples.
2. Define the term element as used in FEA and sketch a few elements for 1D, 2D and 3D situations.
3. Indicate the meaning of the term Near Net Shape Manufacturing and the role of CAE in realizing Near Net Shape Manufacturing.
4. Obtain the strain rate matrix for a triangular element with three nodes at the vertices.
5. What are the possible boundary conditions at the tool work interface in metal forming problems?
6. Provide examples for deformations in metal forming processes that are of (a) plane strain(b) plane stress and (c) axis-symmetric . Justify.
7. How is element connectivity defined and implemented while computing?
8. Interpret the meshing in the following figure.

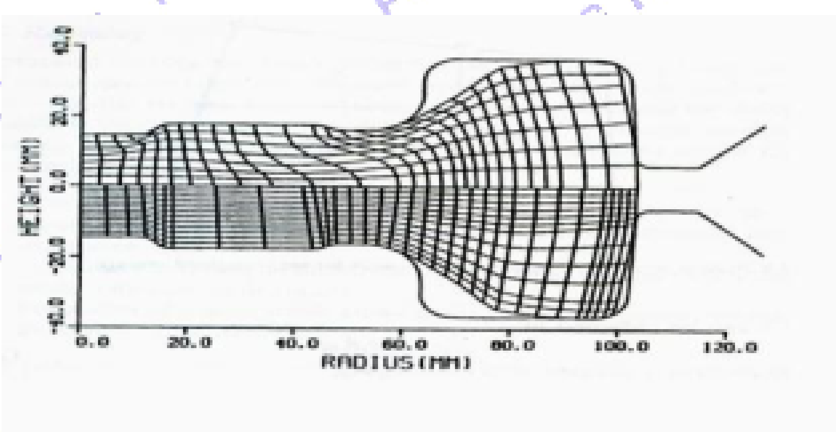


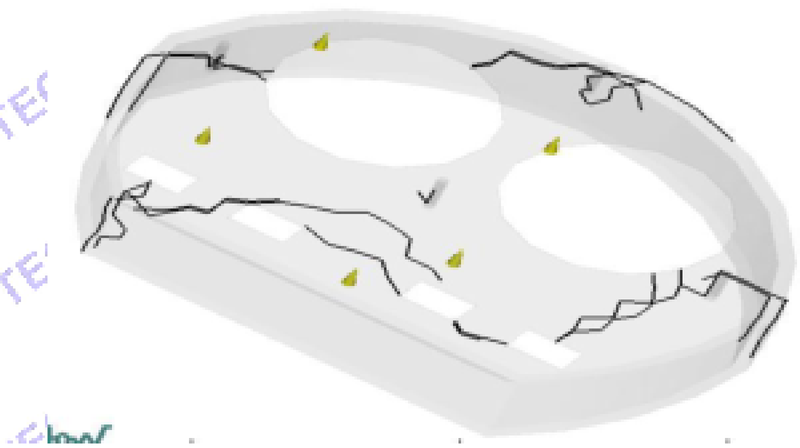
Figure for Qn. 8

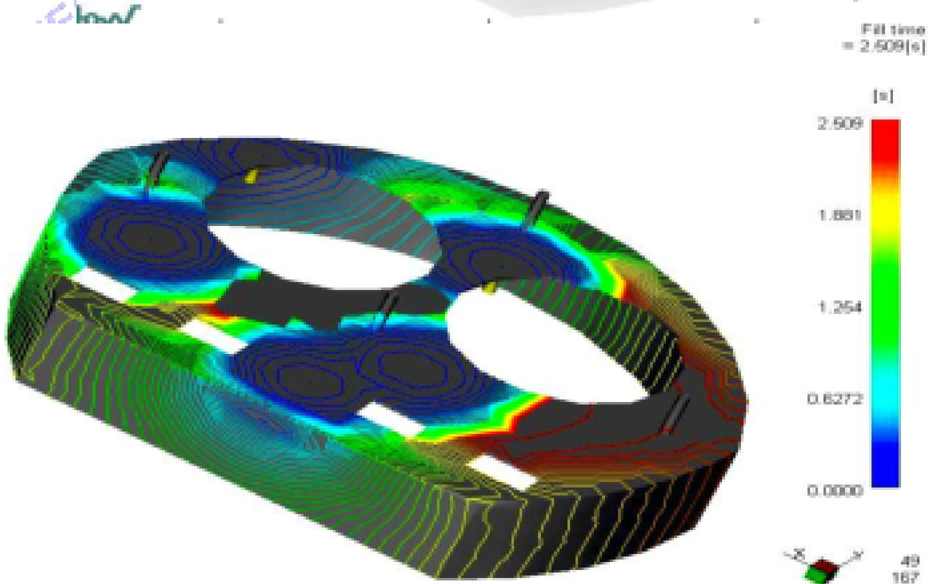
9. Name a few defects that can be detected by a CAE based simulation of metal casting process. Provide a few sketches for these defects.

10. Name a few softwares that are finite element based and specific for design and manufacture of automotive components. Sketch any one component that is designed and manufactured in this way.

GROUP II **Marks : 6 x 10 = 60**

11. Present the structure of programme that solves a metal forming problem using FEA. The function of each module is to be explained.
12. How is slab method of analysis different from finite element analysis of metal forming problems? Explain with example.
13. Model the problem of metal casting(conventional sand casting) and obtain the finite element equations to determine the temperature distribution. Suitable assumptions can be made.
14. Model the problem of distortion in welding and derive the necessary equations to solve using FEA.
15. How is addition of filler material modeled in FEA of welding processes?
16. Obtain the general expression for strain rate matrix for a metal forming problem that can have plane stress/plane strain /axis-symmetric deformations.
17. Study the figures below. Identify the part and the interpret the results obtained from analysis. How can the results be improved? Will the designer need any more data to make decision?





Figures for Qn. No. 17

FD/RL

/END/

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Write the Alphabet of your choice answer for each question in the space provided in the Main Answer Book
(Do not attach this question paper along with the Main Answer Book)

APRIL – 2014

08P005 FINITE ELEMENT APPLICATIONS IN MANUFACTURING

GROUP III **Marks: 10 x 1 = 10**

I) Isoparametric elements use shape functions for

A) interpolation **B)** integration **C)** coordinate transformation **D)** mapping node

II) Consider the functional $\pi = \int \bar{\sigma} \dot{\bar{\epsilon}}\, dv - \int F_i u_i \, dS$

formulated for the plastic deformation of a rigid plastic material
The first integral represents

A) strain energy **B)** potential

C) work done by surface forces **D)** boundary conditions

III) For a rigid plastic material Incompressibility condition implies

A) sum of principal strains is zero **B)** sum of principal stresses zero

C) sum of normal velocities is zero **D)** A, C

IV) For the transformation from natural coordinate system to global coordinate system Jacobian is to be

A) negative **B)** zero **C)** positive **D)** infinite

V) Casting of a long section like lathe bed can be idealized and analysed using FEA as a

A) 2D problem **B)** 3D problem **C)** 1D problem **D)** axis-symmetric l problem

VI) Distortion in welding is modeled as

A) fusion problem **B)** mass transfer problem

C) thermo-mechanical problem **D)** structural problem

VII) Aspect ratio in meshing influences

A) errors **B)** convergence **C)** CPU time **D)** A,B,C

VIII) To predict distortion in an injection molded component--------------- analysis is needed.

A) Warpage **B)** multi-laminate filling **C)** cooling **D)** A,B,C

IX) CAD and CAE models of a domain are

A) geometrically similar **B)** dimensionally similar

C) Functionally similar **D)** Functionally dissimilar

X) If a node in the finite element mesh is not connected this leads to

A) errors **B)** no error as connecting is optional

C) change in aspect ratio **D)** A,C